REPLY TO EXAMINER'S ANSWER - PATENTS
PATENT
3430-0105P

IN THE U. S. PATENT AND TRADEMARK OFFICE

Before the Board of Patent Appeals and Interferences

Appellant:	Jeongmin MOON	Conf. No.:	1734
Serial No.:	09/589,881	Group:	2871
Filed:	June 9, 2000	Examiner:	H. NGUYEN

For: REFLECTIVE LIQUID CRYSTAL DISPLAY DEVICE HAVING AN AUXILIARY LIGHT SOURCE DEVICE

REPLY BRIEF TO EXAMINER'S ANSWER

MS REPLY BRIEF - PATENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 11, 2005 (after Holiday)

Sir:

Pursuant to 37 C.F.R. §1.193 (Rule 193), this is a Reply to the Examiner's Answer dated August 9, 2005, which was in response to Applicant's Appeal Brief filed on June 1, 2005. The Appeal Brief was filed to appeal the action of the Examiner dated September 23, 2004, finally rejecting claims 1-4, 6-11, 14-21, 23 and 24. Claims 1, 10, 11 and 21 are independent.

Claims 1-4, 6-11, 14-21, 23 and 24 are rejected under 35 U.S.C. § 102(e) as being anticipated by Shinji et al. (U.S. Patent 6,259,854). Claim 10 is rejected under 35 U.S.C. § 102(b) as being anticipated by Funamoto et al. (EP 08 878 720).

<u>SUMMARY OF ARGUMENTS PRESENTED IN THE APPEAL BRIEF AND THE EXAMINER'S RESPONSE IN THE EXAMINER'S ANSWER</u>

In the Appeal Brief, Applicant demonstrated the following:

- Shinji cannot be relied upon to teach or suggest the feature that when the angle between the lower surface and a surface connecting the planar surface of the convex portion is about 90°, the light reflected along an orthogonal direction to the liquid crystal display device is uniform. (*See Appeal Brief, page 10, line 1 – page 11, line 13*);
- Examiner has not demonstrated that directing incident light from the light source toward the reflector outwardly along an orthogonal direction is inherent in Shinji (*See Appeal Brief, page 11, line 14 – page 14, line 9*); and
- Funamoto cannot be relied upon to teach or suggest the feature of "a display panel including two substrates spaced apart, liquid crystal sandwiched between the two substrates, and a reflector in the display panel to reflect light through the liquid crystal." (*See Appeal Brief, page 15, line 17 – page 16, line 21*).

The Examiner attempted to address each of these arguments in the Examiner's Answer. Failure on the Examiner to address any of the arguments

renders the claims allowable. But as will be demonstrated below, the Examiner's response falls short on all attempts.

SHINJI DOES NOT TEACH THAT WHEN THE ANGLE BETWEEN THE LOWER SURFACE AND A SURFACE CONNECTING THE PLANAR SURFACE OF THE CONVEX PORTION IS ABOUT 90°, THE LIGHT REFLECTED ALONG AN ORTHOGONAL DIRECTION TO THE LIQUID CRYSTAL DISPLAY DEVICE IS UNIFORM

Independent claim 1 recites, in part "an **angle** between the lower surface and a surface connecting the planar surface of the convex portion **is about 90°**, wherein **light reflected** along an **orthogonal direction** to the liquid crystal display device **is uniform**." *Emphasis added.* In other words, the light reflected along the orthogonal direction is uniform when the angle between the lower surface and the surface connecting the planar surface is about 90°. Independent claims 10, 11 and 21 also recite similar features.

For explanation purposes only, Figure 4 and 5 of the Applicant's application are attached. As illustrated in Figure 4, a light source 503 having a lamp reflector 505 directs light into one side of a light directing member 501. The sidewalls, except for the side near the light source has a sidewall reflector 521. Entering light reflects off the various walls of the light directing member.

The lower surface 509 contains a plurality of convex portions. When light strikes a side of one of the convex portions, it becomes directed downwardly substantially perpendicular to the reflector 507.

Figure 5 shows an enlarged view of the convex portions. Angles 523 are in the range of 0° to 10° and accordingly the angle between surfaces 515 or 517 and surface 513 is between 90° and 100°.

In claim 1 as noted above, the angle between the surface 517 and the surface 513 is about 90°. Accordingly, angle 523 is about 0°. When this occurs, independent claim 1 requires that the light reflected along the orthogonal direction is uniform.

In the Appeal Brief filed on June 1, 2005, it was clearly demonstrated that at comparable angles, the light source and light reflecting member as disclosed in Shinji cannot be relied upon to teach or suggest the above recited feature.

Shinji discusses the characteristics of the luminance distribution and the angles of the trapezoidal surfaces of the protrusions. More specifically, Shinji shows charts of the reflection efficiency for angle δ between 0 and 40°. *See Shinji, Figures 5-11.* Angle δ is the complement of the angle described in claim 1. Thus, the angle δ should be near 0° when the claimed angle is about 90°.

As noted in the Appeal Brief, Applicants agree that having the angle δ between 0 or 2° is equivalent to the claimed angle being about 90°.

Shinji specifically discloses that luminance is **not** uniform when the angle δ is near 0°. Shinji states, "A protruding resist pattern which has a **slope angle δ<3°** ... was obtained ... When the distribution of luminance was measured, **its uniformity ratio of illuminance was bad** as its luminance around the light source is low and is high at the end ..." *See Shinji, column 11, lines 54-67.* In other words, when the angle δ<3°, Shinji specifically teaches that the luminance is **not** uniform from one end of the lightguide to the other. This is completely contrary to the feature as recited in claim 1.

Thus, it is clear that Shinji does not teach or suggest the above recited feature.

EXAMINER FAILED TO DEMONSTRATE THAT DIRECTING LIGHT TO A REFLECTOR OUTWARDLY IN AN ORTHOGONAL DIRECTION IS INHERENT IN SHINJI

Independent claim 1 recites, in part "an angle between the lower surface and a surface connecting the planar surface of the convex portion is about 90°, wherein **light reflected along an orthogonal direction** to the liquid crystal display device is uniform." *Emphasis added.*

Applicants argued in the Appeal Brief that the Examiner did not demonstrate that there exists in Shinji an incident angle Θ **less than** the critical angle Θc that will produce a light which is deflected downwards. In the Examiner's Answer, the Examiner attempts to demonstrate that such an angle Θ exists when the angle δ is at 0° and 2°.

The Examiner attempts to use Snell's Law to demonstrate that there is a particular angle "Θ" less than the critical angle Θc that will produce a light which is deflected downwards. *See Examiner's Answer, pages 10 and 12.* In Shinji, the critical angle Θc is disclosed to be 47.8° for a light guide with a refractive index of 1.49. *See Shinji, Figure 4; column 6, lines 39-46.*

As seen in Figure 4 of Shinji, the angles Θc and Θ are measured from the **planar plane** defined by edge AD to the incident light L4. **However**, Snell's law is customarily expressed based on angles from the **normal to the plane** defining the boundary between materials. *See attached Appendix on Snell's law description.*

Thus, in order to use Snell's Law, the Examiner should have converted the critical angle Θc as disclosed in Shinji to the convention of the Snell's Law. The Examiner failed to do so. Instead, the Examiner bases his analysis on the wrong value of the critical angle and the Examiner's demonstration is flawed.

Therefore, the **Examiner fails to demonstrate** that the feature of directing light to a reflector outwardly in an orthogonal direction is inherent in Shinji.

REFLECTOR IS NOT INCLUDED IN THE DISPLAY PANEL OF FUNAMOTO

In the Examiner's Answer, the Examiner alleges that the features of "the reflector is included in the display panel" and "the reflector is one part of the display panel" are not recited in claim 10. *See Examiner's Answer, page 11, lines 16-19.* The Examiner also alleges that there are no drawings to illustrate these features.

However, claim 10 recites, in part "a display panel **including** ... **a reflector** to reflect light through the liquid crystal." *Emphasis added.* In addition, these features are disclosed in Figure 4, immediately above the reflector 507. Clearly, the Examiner's allegation fails.

In addition, the Examiner alleges that Funamoto, in Figure 10, shows that the reflector is included in the display panel and that the reflector is one part of the display panel.

However, Figure 10 and the related descriptions of Funamoto describe element 102 as the "liquid crystal display panel 102" and that the reflecting plate 103 is "arranged at the back face of the liquid crystal display panel 102." *See Funamoto, page 8, lines 53-56.* Clearly, Funamoto teaches that the

reflecting plate 103 and the liquid crystal display panel 102 are **separate**, which is contrary to the Examiner's allegation.

It should be noted that Funamoto refers to the element 102 only as the liquid crystal display panel, and never as the liquid crystal cell. Again, this contradicts the Examiner.

VIII. SUMMARY

In view of the above, Applicants submit that the final rejection by the Examiner is incorrect. Accordingly, Applicants request that the Examiner be reversed and that the application be allowed.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge any payment or credit any overpayment to Deposit Account No. 02-2448. This authorization applies to any additional fees required under 37 CFR §1.16 and 37 CFR §1.17 and in particular to fees for an extension of time.

Respectfully submitted,

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Appendix: FIGURES 4 AND 5 OF THE DISCLOSURE
SNELL'S LAW DESCRIPTION

EHC/~~HNS~~ HNS
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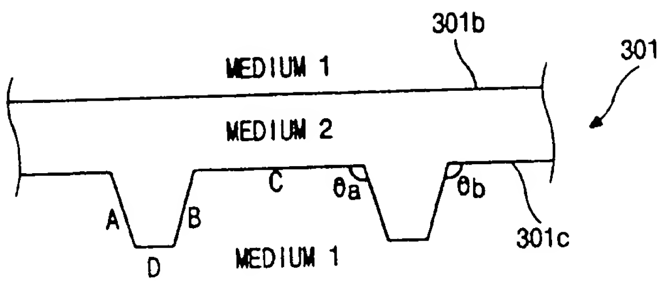

301b
301
MEDIUM 1
MEDIUM 2
C
θa
θb
A
B
301c
D
MEDIUM 1

FIG. 3

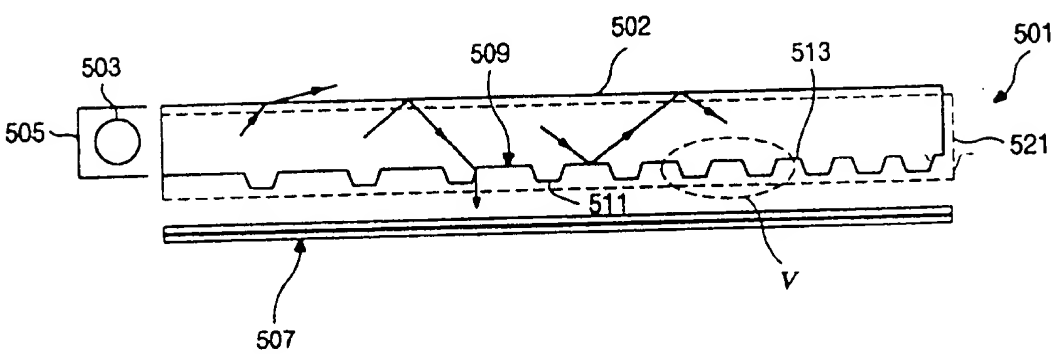

502
501
503
509
513
505
521
511
V
507

FIG. 4

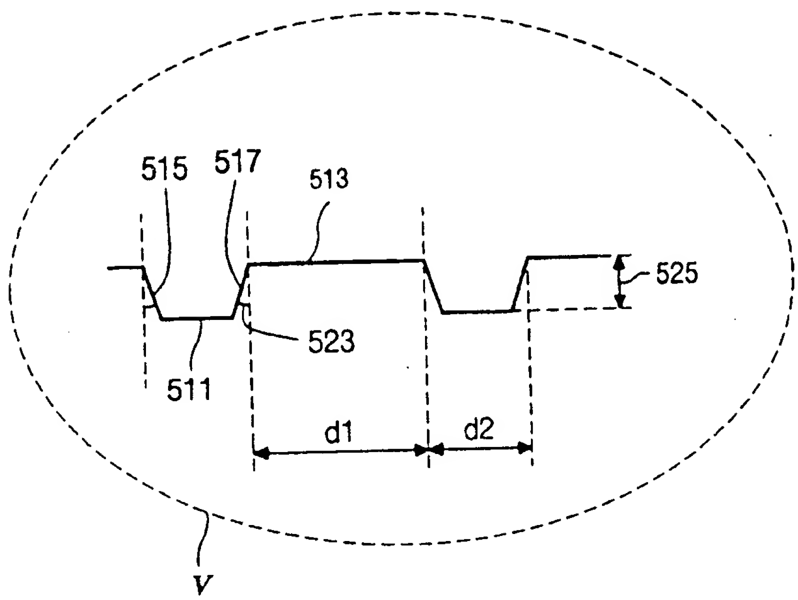


FIG. 5

Core Unit III: Light
C. Refraction

1. Snell's Law

Key Concepts

Refraction is the bending of light that takes place at a **boundary** between two materials having different indices of refraction. Refraction is due to a change in the speed of light as it passes from one medium to another.

The boundary is the region where one medium meets another medium WWW Resources .

At a boundary, an incident ray can undergo **partial reflection** or, in certain situations, **total internal reflection**.

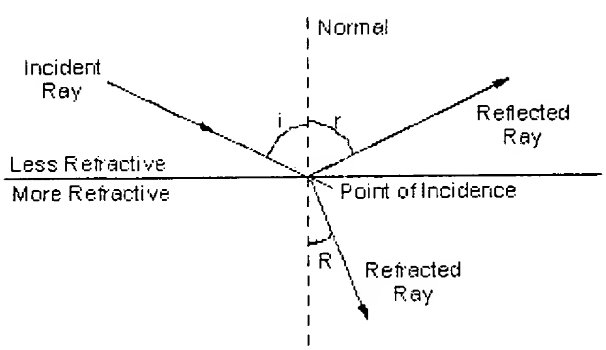
No bending of the incident ray occurs if it strikes the boundary along the normal.

The **incident ray** is the ray approaching the boundary. It strikes the boundary at the point of incidence. The refracted ray is the ray leaving the boundary through the second medium.

The **reflected ray** is the ray undergoing partial (or total) reflection at the boundary. The **normal** is a construction line drawn perpendicular to the boundary at the **point of incidence**.

The **angle of incidence** (*i*) is the angle between the incident ray and the normal. The **angle of reflection** (*r*) is the angle between the normal and the reflected ray.

The **angle of refraction** (*R*) is the angle between the normal and the refracted ray.



Both Reflection and Refraction occur when the light is incident on a more refractive medium.

Some texts use the symbol **r** for the angle of refraction. The use of the same symbol to represent both the angle of reflection and the angle of refraction can be very confusing and should be avoided.

Laws of Refraction:

1. The ratio of sines of the angles of incidence and refraction is a constant. (Snell's Law) (The ratio is constant for a particular wavelength and a particular set of materials.)

2. The incident and refracted rays are on opposite sides of the normal at the point of incidence.

3. The incident ray, the normal, and the refracted ray are coplanar.

Snell's Law: $\frac{\sin i}{\sin R} = n$ where n is a constant.

the constant is the ratio of the speeds of light in the two media.)

General form: $\frac{\sin\theta_1}{\sin\theta_2} = \frac{n_2}{n_1}$

$$n = \frac{n_2}{n_1} = \frac{v_1}{v_2}$$

or, $n_1 \sin\theta_1 = n_2 \sin\theta_2$

(The absolute index of refraction for a given medium is defined as: $n = c/v$ where c is the speed of light in a vacuum and v is the speed of light in the medium. Also, the ratio n_2/n_1 is called the **relative index of refraction**.)

Subscript 1 is customarily used to represent the incident medium. Subscript 2 epresents the refractive medium. The equation is valid regardless of the direction in which light is travelling through the two media. (*i.e.*, The Principle of Reversibility applies).

If light is travelling from a less refractive medium to a more refractive medium (*i.e.*, $n_2 > n_1$), the refracted ray will be bent towards the normal.

The term **optical density**, as is sometimes used, is misleading and should be avoided. There is no relationship between the mass density of a medium and its optical density. For example, benzene and corn oil, which both float on water, have higher refractive indices than water. Optical density refers to the transparency of the medium and has nothing to do with its refractive index.

Newton's experiments illustrated the **dispersion** of sunlight into a **spectrum** (and **recombination** into white light). Sunlight consists of amixture of light with different wavelengths. A **dispersive medium** is one in which different wavelengths of light have slightly different indices of refraction. For example, crown glass is a dispersive medium since the index of refraction for violet light in crown glass is higher than for red light. This is responsible for chromatic aberration. (Manufacturers of optical glass customarily specify the refractive index of a material for yellow sodium light, the D line.)

Light passing through a **rectangular prism** can experience **lateral displacement**. In a prism with non-parallel sides, the displacement is described by the **angle of deviation** between the ray incident to the prism and the ray emerging from it.

Many examples found in commonly observed phenomena and practical applications illustrate refraction and total internal reflection. (Several should be described and discussed or researched independently by students.)

Learning Outcomes

Students will increase their abilities to:

1. Define the following terms: refraction, boundary, partial reflection, point of incidence, refracted ray, angle of refraction, spectrum, dispersion, dispersive medium, chromatic aberration, lateral displacement, angle of deviation.
2. Explain why refraction occurs.
3. Explain that no bending of the incident ray occurs if it strikes the boundary while travelling along the normal.
4. Draw and label a diagram which illustrates the way in which light behaves when it undergoes refraction.
5. State the three laws of refraction.
6. Apply Snell's Law to solve problems relating to refraction.
7. Recognize the direction that a refracted light ray will bend, depending on the relative index of refraction for the two media.
8. Explain what causes chromatic aberration.
9. Solve problems relating to the refraction of light.
10. Identify several applications or examples from common experience which illustrate the refraction of light WWW Resources .

Teaching Suggestions, Activities and Demonstrations

1. Perform an activity to investigate the refraction of light.
2. Illustrate experimentally that when sunlight enters a dispersive medium, such as a prism, dispersion occurs.
3. Explain or demonstrate the experimental techniques that Newton used to investigate the dispersion and subsequent recombination of sunlight by a prism.
4. Perform an activity to investigate the lateral displacement of light through a rectangular prism.

5. Using a glass equilateral prism, or some other apparatus, determine the index of refraction for one type of glass, or some other medium.

6. Design an experiment to determine the index of refraction of a variety of transparent solid or liquid substances. Some students may be able to build small transparent plexiglass cubes and prisms that can be filled with different types of transparent fluids to investigate refraction.

7. Design an experiment to investigate the concentration of a sugar solution and its index of refraction.

8. Slowly pour water containing a colloidal suspension over a layer of sugar crystals in the bottom of an aquarium, trying not to allow too much turbulence to develop in the water. Allow a concentration gradient to form in the sugar solution. Predict what will happen when a beam of light shines through the solution. Shine a beam through the solution. Account for the curved path that the beam follows in the liquid.

9. A laser beam provides an excellent source of light for various optics demonstrations. Modern technology has reduced both the size and the cost of this light source. Consider purchasing one for the science lab, if one is not currently available.

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